

**Written Testimony of Society for Neuroscience
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**Before the
House Subcommittee on Labor, Health and Human Services and Education**

Presented by

Stephen Heinemann, PhD, Society for Neuroscience President

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Summary:

The Society for Neuroscience, with over 37,500 members worldwide, who are devoted to advancing the understanding of the brain and nervous system, respectfully requests a 5 percent increase for the National Institutes of Health (NIH) in FY 2007. Significant scientific advances in stroke, Alzheimer's disease, Parkinson's disease, and Post-Traumatic Stress Disorder, were made that led to concrete improvements in U.S. public health. Such improvement are owed to this Subcommittee's commitment to federal funding of the NIH. My own research is focused on the molecular mechanism of learning and memory, and finding new targets to treat depression, Alzheimer's Disease, and nicotine addiction. Society for Neuroscience is concerned about the impact that decreased science funding could have on biomedicine; namely, our concern for the young investigators who already have to wait until they are an average of 43 years old before receiving their first grant. That is a long time to wait to begin one's career and this could cause the U.S. to lose the innovation of great young minds to other fields. Also advancing innovation, we feel that the Blueprint for the Brain at NIH could help to accelerate discoveries in neuroscience. Based on previous success stories derived from federal science funding, SfN asks that this Subcommittee consider a 5 percent increase for NIH in FY 2007.

Stephen F. Heinemann, PhD
Molecular Neurobiology Laboratory
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Stephen F. Heinemann, a professor in the Molecular Neurobiology Laboratory, studies the molecular details of communication among brain cells. The synapse plays a key role in communicating information between brain cells and it is likely that biochemical changes at the synapse underlie some aspects of higher brain function. Most plausible theories of learning and memory depend upon changes in the efficiency of chemical synapses, which probably involves changes in receptors, ion channels and neurotransmitter release. It is also now known that these molecules can be directly involved in human disease. Most drugs that are used to treat mental illness are known to work either on the receptors or the metabolism of the transmitters at the synapse. The work in the laboratory is focused on the molecular biology and physiology of the glutamate and nicotinic receptors expressed in the brain. A major goal is to understand the regulation of synaptic function and the molecular biology of learning.

Among other notable achievements, his lab has isolated a gene containing the blueprints for a receptor critical to learning and memory, and identified the receptors that respond to nicotine. Since neurological ailments, such as Alzheimer's and Parkinson's; drug addiction; and mental disorders, such as depression and schizophrenia, are fundamentally disorders of brain cell communication, this research will provide new insights into the treatment of these disorders. Discoveries in Heinemann's lab are currently being used by pharmaceutical and biotechnology companies to develop drugs for stroke, epilepsy, Parkinson's and Alzheimer's diseases, as well as mental conditions, such as nicotine addiction, depression and schizophrenia.

Education

B.S., California Institute of Technology

Ph.D., Biochemistry, Harvard University, 1967

Postdoctoral fellow, Massachusetts Institute of Technology and Stanford University

Awards & Honors

National Academy of Sciences (USA)

National Institute of Medicine (USA)

American Academy of Arts & Sciences

Bristol-Myers Squibb Distinguished Achievement in Neuroscience Research Award, 1995

McKnight Award for Research, 1991-1997

Recent Publications

-Contractor, A., Rogers, C., Maron, C., Henkemeyer, M., Swanson, G.T. and Heinemann, S.F.: Trans-Synaptic Eph Receptor-Ephrin Signaling in Hippocampal Mossy Fiber LTP. *Science* 296: 1864-1869 (2002).

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Introduction

Mr. Chairman and members of the subcommittee, I am Stephen Heinemann, PhD, President of the Society for Neuroscience (SfN) and Professor of Molecular Neurobiology at the Salk Institute in San Diego, California. I am here today to ask for your support of neuroscience research. The Society for Neuroscience represents a host of scientific research efforts aimed at understanding the brain and the nervous system and using this knowledge to treat and prevent diseases of the brain and nervous system.

What is the Society for Neuroscience?

The Society for Neuroscience is a nonprofit membership organization of basic scientists and physicians. Neuroscience includes the study of brain development, sensation and perception, learning and memory, movement, sleep, stress, aging, and neurological and psychological disorders. It also includes the molecules, cells and genes responsible for nervous system functioning.

Recognizing the tremendous potential for the study of the brain and nervous system as a separate field, the Society was formed in 1970. SfN has grown from 500 members to more than 37,500 and is the world's largest organization of scientists devoted to the study of the brain.

SfN's primary goal is to advance the understanding of the brain and the nervous system by bringing together scientists of diverse backgrounds, by facilitating the integration of research, and by encouraging the application of new scientific knowledge to develop improved disease treatments and cures. Another of our goals is to convey to legislators, new scientific knowledge, recent developments, and emerging opportunities in neuroscience research and their implications for public policy, societal benefit, and continued scientific progress.

Research Successes

The Society for Neuroscience would like to thank the members of this Subcommittee for its past support. Over the past several decades, funding from National Institutes of Health (NIH) has helped the neuroscience community make great strides in improving the health and quality of life for the American public. In fact, SfN has created a 24-part series called *Brain Research Success Stories* that cite the progress that has resulted from federal funding for biomedical research. The following are but a few of the areas where our research efforts have helped the American public:

1. *Stroke* – Until recently the outlook was especially grim for the 700,000 Americans estimated to experience a stroke each year. These “brain attacks” occur when a blockage bursts or clogs the blood vessel bringing oxygen and nutrients to the brain and then brain cells die. In the past, those who survived this third leading cause of death would have likely lived out their remaining days with serious disabilities that harmed their independence, ability to work, and quality of life. Fortunately research has helped produce new strategies that have dramatically improved the once-bleak situation-surrounding stroke.

Basic science discoveries guided the successful development of the only currently established clinical treatment for stroke. This therapy, tissue plasminogen activator, or tPA, if given within hours of the onset of a stroke, can rapidly dissolve blockages, restore blood flow, and ward off brain damage. It helps patients with a common form of stroke survive and achieve a complete recovery when given within three hours of an attack. Research indicates that tPA-treated patients have shorter hospital stays than patients not treated with tPA and are more frequently discharged to their homes than to rehabilitation centers or nursing homes. This translates into improved quality of life for patients and millions of dollars in savings for the health care system.

Even with improvements in prevention and treatment, stroke remains a leading cause of serious, long-term disability. Experimental techniques, however, are helping these impaired survivors. One promising method, constraint-induced movement therapy, was developed with the aid of funding from NIH. Hundreds of patients have received this treatment. With further research and refinements it could aid many more disabled individuals.

2. Alzheimer Disease – Four to five million older Americans live with Alzheimer's disease, a frightening and costly memory-robbing disorder. By 2010, Medicare costs for beneficiaries with Alzheimer's disease are expected to increase more than 50 percent from about \$31 billion in 2000 to \$49 billion. Medicaid expenditures on nursing facility care alone will increase 80 percent from about \$18 billion to \$33 billion. This is an epidemic that has already reached our shores and we know with certainty will only get worse. The potential for lowered costs in health care and lost productivity through research is enormous. For instance, treatments that delay the onset and progression of Alzheimer's disease by just five years could save the country \$50 billion annually. Even more encouraging, basic research supported by NIH has led to a breakthrough in our understanding of the cause of Alzheimer's disease. This has led to many new targets for drugs being developed by the pharmaceutical industry. There is now real hope that it will be possible to delay or prevent this terrible disease that destroys human minds.

To reduce the health care burden of the disease, NIH-funded research has generated new treatments that can aid memory, thinking, and functional abilities in patients with the condition. Improvements allow some patients to resume normal routines in life. Other drugs target a part of the brain that slows memory deterioration. These treatments stabilize patient's health and reduce both care-giver time and healthcare costs.

3. Parkinson's Disease – Each year, about 50,000 Americans are diagnosed with Parkinson's disease, joining the estimated 1 million people already living in the United States with this serious and disabling brain disorder. Parkinson's occurs when nerve cells become damaged or destroyed in an area of the brain that is important for normal voluntary movement and coordination. People with

Parkinson's experience trembling, muscle stiffness, and slowness of movement. They also often experience depression, anxiety, dementia, urinary difficulties, and sleep disturbances. Symptoms tend to worsen over time.

For scientists studying Parkinson's, the first great "eureka" moment came in the 1960s with the discovery that the disease is associated with a loss of the brain chemical dopamine. From that research breakthrough came one of modern medicine's major triumphs: the drug levodopa (L-dopa), which turns into dopamine once it gets into the brain. In 1970, L-dopa became the first drug approved specifically for the treatment of Parkinson's. It largely replaced surgery, the only treatment available at the time. However, L-dopa must be taken in ever-increasing doses as Parkinson's progresses, but this can lead to debilitating side effects, from involuntary movements to hallucinations.

Scientists have developed additional drugs and strategies over the years. Surgical treatments have made a comeback in recent years, thanks in large part to the development of animal models of Parkinson's. These models have enabled scientists to pinpoint which structures deep within the brain are contributing to symptoms of Parkinson's – and thus are targets for therapeutic intervention.

4. Post-Traumatic Stress Disorder – Experiencing or witnessing a crime, battle, or terrorist attack, or being a victim of sexual abuse, can lead to a form of stress that can last a lifetime. Termed post-traumatic stress disorder, or PTSD, the condition afflicts 5.2 million Americans aged 18 to 54 each year. Its social and economic costs can be devastating.

Scientific studies funded by NIH helped reveal that PTSD is a serious brain disorder with biological underpinnings. New understanding of the disorder paved the way for use of so-called selective serotonin reuptake inhibitors in treating PTSD. Studies funded by NIH found that these drugs ease the symptoms of depression and anxiety. They are the only agents currently approved for treating the symptoms of PTSD.

My Research

My laboratory discovered the genes that produce the receptors that are crucial for communication between nerve cells in our brain and are critical for normal function. Currently, my research is focused on the molecular mechanism of learning and memory, and finding new targets to treat depression, Alzheimer's Disease, and nicotine addiction. These are major diseases that are epidemic in our country and threaten the health of the American People and our economic security.

Impact of Budget on Research

The Bush Administration's budget proposal for FY 2007 is not adequate to continue current biomedical research activity. The \$28.6 billion proposed FY 2007 budget for the National Institutes of Health represents a hard freeze for the agency. The progress made by the recent doubling of the NIH budget is now in jeopardy.

Already, the average age when researchers receive their first grant has risen from 35 in 1951 to 43 in 2004. That is a very late age to begin a career and without further grant money, we will lose minds to other fields and countries. These scientists and their potential for innovation are what drive U.S. competitiveness in biomedicine and biotechnology. NIH did not become the premiere biomedical research institution it is today by accident. It took support from Congressional leaders like you to invest in the best facilities, research, and projects selected through our and projects selected through our non-political, rigorous and competitive peer review system envied and now being emulated around the world.

Also, research drives innovation and productivity, creates jobs, and fuels local and regional economies. In FY 2004, medical schools in the state of Ohio brought over \$426 million dollars into the state from NIH-funded research.

Diseases of the nervous system pose a significant public health and economic challenge, affecting nearly one in three Americans at some point in life. Understanding how the brain and nervous system develops, works, and ages – in health and disease – is the goal of neuroscientists. Improved health outcomes and economic data reinforce our assertion that increased investment in biomedical research is needed today to improve public health tomorrow.

Over the past few years, NIH's institutes and centers with an interest in neuroscience have increasingly joined forces through initiatives, working groups, and programs focusing on resources and scientific issues, including predoctoral training, gene expression, pain, stem cells, neurodegeneration, and integrating intramural neuroscience research. These institutes and centers have developed a "Blueprint" designed to accelerate the pace of discovery and building on this foundation, making collaboration a day-to-day part of how the NIH does business in neuroscience. Its initial focus is on tools, resources, and training that can build on existing research programs. A major emphasis will be integration of neuroscience across all levels of analysis, from molecules through cells to the functional systems responsible for perception, thinking, emotion, and behavior. The Blueprint will accelerate the translation of basic neuroscience discoveries into better ways to treat and prevent nervous system diseases. The success of this blueprint to help Americans with Brain diseases depends on the availability of funds.

FY 2007 Budget Request

Mr. Chairman, inflation has eaten into the NIH budget. The NIH now projects the Biomedical Research and Development Price Index (BRDPI) to increase by 4.1 percent for FY 2006; 3.8 percent for FY 2007 and FY 2008. Unfortunately, the President's budget for NIH did not factor in the increases in the Biomedical Research and Development Price Index.

The Society for Neuroscience supports the Ad Hoc Group for Medical Research Funding request of a 5 percent increase for NIH in FY 2007. This will help NIH to achieve its broad research goals as well as help people affected by neurological disorders. It also will

help ensure that our best and brightest young people will enter the field to help to continue to make the neuroscience research advances that are so vital to achieving a healthier nation and a robust economy.

Mr. Chairman, thank you for the opportunity to testify before this committee.